JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

October 30, 2001

To: K. Moyd

From: D. Morris and K. Martinez

Subject: Feasibility of Sending Deep Space 1 To Asteroid 1999KK1

Reference: "Preliminary Tracking Coverage Guidelines For 1999KK1," email, dated 25 October 2001, from K. Moyd and forwarded by R. Benson.

This is an analysis of the availability of DSN communications to support a possible Deep Space 1 (DS1) Extended Mission culminating with Asteroid 1999KK1 Encounter on or around 3 August 2002. The 'Wake-up" event (late June) through Encounter are evaluated in this report. There are many factors that will affect DS1 support and these are enumerated throughout the report. If a go-ahead is given soon, negotiation can begin to allocate the requested time and fully support DS1's request for DSN support. It is important that DS1 retain the flexibility to use any X-band antenna as defined in the referenced Guidelines.

K. Yetter will provide under separate cover an analysis of the period from the current end-of-mission (December 2001) through the end of April 2002. Presently, the Resource Allocation Planning Team is already negotiating the Mid-Range Allocation through the end of April 2002. May is beginning to be developed. This means that timely decisions need to be made in order to begin allocating time for this extended mission.

The referenced guidelines allow the use of any X-band uplink/downlink antenna in the DSN. There are three antennas at each complex with this capability: 70m, 34H and 34BWG. One antenna will be unavailable to DS1. The 70m antenna at Goldstone, DSS-14, is scheduled to go down for 70M Servo Drive Upgrade July 15, 2002 through September 27, 2002 (DOYs 196-270; weeks 29-39; 75 days duration). DSS-14 Network Simplification Project Implementation will be implemented on a Non-Interference Basis to the Servo Drive Upgrade activity.

The DS1 Tracking Coverage Guidelines are:

Wake-up (sometime in last two weeks June or first week July – preferably not including July 4)

- For 3 contiguous days need ~12 hours/day.

From Wake-up until July 29

- Two track periods/week of at least 8 hours each
- At least once every two weeks at least three hours in each north-south hemisphere with no more than 1 hour gap between the two sites.

Encounter (July 29 through August 5)

- ~16 hours/day
- (24 hours for the actual encounter day (~August 3– exact time TBD)
- Every other day at least three hours in each north-south hemisphere with no more than 1 hour gap between the two sites.

Requirements Assessment:

Wake-up Event:

The external events that affect this period in late June or early July are either spacecraft or asset related. Mars coverage requirements could be consolidated some by using MSPA. Timing of the 'Wake-up' should be worked around the MGS coverage and DSS Maintenance. Both Cassini and the Mars Missions nearly rise with the Sun and will be affected by DSS Maintenance support. An initial inspection of the preliminary allocation shows limited DSN Madrid support. In conclusion, the details of these events that are external to DS1, warrant that this 'Wake-up' event should occur during the week of June 17, 2002 to avoid at least two of these five possible contentions.

1. Cassini Superior Conjunction Radio Science Observation begins the first week of June and concludes in the first week of July. Continuous coverage using DSS-25 (full view), DSS-45 and DSS-65 are required. There is a 50% overlap between Cassini and DS1.
2. Contour Launch Period begins July 1, 2002 and extends to July 25, 2002. They need continuous coverage and initially inject into a Earth Phasing orbit with a 1.75 Day Period. Some DS1 overlap is expected.
3. Mars Global Surveyor (MGS) is in a mapping 'Beta Supplement' phase requesting at least 12 hours per day with 24 hours requested every third day. There is a 50% overlap between MGS and DS1.
4. 2001 Mars Odyssey (M01O) is in their high rate Themis Support requiring 14 hours per day on the 70M subnet. There is a 50% overlap between M01O and DS1.
5. DSS-66 is scheduled to go down for Servo Hydraulic Drive Replacement from June 24, 2002 through July 21, 2002 (DOYs 175-202; weeks 26-29; 28 days duration). This activity may force some S-band users to use DSS-54.

From Wake-up until July 29:

The external events that affect this period in July are either spacecraft or asset related. The events listed for the 'Wake-up' event are similar with the added requirements, beginning July 15, to support SIRTF Launch and antenna Downtime for DSS-14 Servo Drive Upgrade. Mars coverage requirements could be consolidated some by using MSPA. Timing of the 'Wake-up' should be worked around the MGS coverage and DSS Maintenance. Both Cassini and the Mars Missions nearly rise with the Sun and will be affected by DSS Maintenance support. An initial inspection of the preliminary allocation shows limited DSN Madrid support, but time at DSS-25 will be available after Cassini completes its Radio Science Observation. In conclusion, the DS1 coverage request should be supportable using Goldstone and Canberra.

Encounter:

The external events that affect the encounter phase (July 29 through August 5) are due to spacecraft events or asset downtime. The key events that will affect daily coverage are listed here. With DSS-14 down, 70M subnet will only partially be available after the Mars view sets each day. If both Contour and SIRTF launches are supported with continuous coverage in this week, 34 meter coverage will be difficult to negotiate.

1. Contour Launch Period begins July 1, 2002 and extends to July 25, 2002. They need continuous coverage and initially inject into a Earth Phasing orbit with a 1.75 Day Period. Some DS1 overlap is expected. If the launch occurs late in the Launch Period, some impact should be expected.
2. Mars Global Surveyor (MGS) is in a mapping 'Beta Supplement' phase requesting at least 12 hours per day with 24 hours requested every third day. There is a 50% overlap between MGS and DS1.
3. 2001 Mars Odyssey (M01O) is in their high rate Themis Support requiring 14 hours per day on the 70M subnet. There is a 50% overlap between M01O and DS1.
4. SIRTF Launch Period begins July 15, 2002, but this may change to later in the year.
5. The 70m antenna at Goldstone, DSS-14, is scheduled to go down for 70M Servo Drive Upgrade July 15, 2002 through September 27, 2002 (DOYs 196-270; weeks 29-39; 75 days duration). DSS-14 Network Simplification Project Implementation will be implemented on a Non-Interference Basis to the Servo Drive Upgrade activity. This activity will force M01O to use DSS-43 and 63.

Encounter day, August 3, 2002, is a Saturday and this helps because DSS Maintenance is planned M-F and will not be a factor. The Mars Mission support should be consolidated as much as possible using MSPA and then reduced to provide time for DS1. If this Mars negotiation occurs, and launches are not a factor, DS1 support should be supportable for the Encounter phase.